**Option 1: Surface Discharge (No Action)** 

			Notes
Option Specifications			
Estimated flow per well	gpm	12	1
Estimated flow	gpm		
Estimated flow	gpd		
Estimated flow	bpd		
Rip-rap	c.y.	10	2
Piping per well	ft	1320	2
Piping required	ft		
Trench depth	ft	6	3
Trench width	ft	3	2
Excavation volume	c.y.		
Outfall Structure	unit	1	
Land required	acres		4
Costs			
Cost of limestone rock (rip-rap)	\$/c.y.	32.4	5
Piping cost - installed	\$/ft	20	9
Outfall Structure	\$/unit	\$2,000	17
Land acquisition	\$/acre	400	1
Subtotal Direct Costs			
Site preparation	5	% of subtotal direct cost	7
Total Direct Cost			
Insurance	1.5	% of total direct cost	8
Contingency	5	% of total direct cost	8
Total Indirect Cost			
Tatal Carrital Carri	Φ.		
Total Capital Cost	\$		
Annual Operating and Maintenance Costs			
Labor hours	man yrs	0.1	2
Labor cost	\$/yr	\$40,000	9
	Ψ, , .	<b>4</b> .3,333	
Total Annual Costs			

Option 2 & 3: Discharge with Treatment

Notes				
Estimated peak flow per well gpm 60   Estimated average flow per well gpm 12  1   Estimated average flow gpm				Notes
Estimated peak flow per well gpm 60   Estimated average flow per well gpm 12  1   Estimated average flow gpm	Option Specifications			
Estimated average flow		gpm	60	
Estimated average flow	Estimated average flow per well	gpm	12	1
Estimated average flow   bpd   Piping per well   ft   1320   2   Piping per well   ft   1320   2   Piping per well   ft   1320   2   Piping required   ft   15   6   3   3   2   2   2   2   2   2   2   2	Estimated average flow	gpm		
Piping per well         ft         1320         2           Piping required         ft         Trench depth         ft         6         3           Trench depth         ft         6         3         2           Excavation volume         c.y.         2           Land required         acres         10           Tank storage capacity         hrs         1           Max Influent tank size         gal           Max Effluent tank size         gal         Building size required         sq.ft.         11           Costs           Piping cost         \$/ft         20         9           Land acquisition         \$/acre         400         1           Influent tank         \$         12           Effluent tank         \$         12           RO System         \$         12           Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs         Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$         % of subtotal direct cost         7           Sit	Estimated average flow	gpd		
Piping required         ft         6         3           Trench depth         ft         6         3           Trench width         ft         3         2           Excavation volume         c.y.	Estimated average flow	bpd		
Trench depth         ft         6         3           Trench width         ft         3         2           Excavation volume         c.y.         10           Land required         acres         10           Tank storage capacity         hrs         1           Max Influent tank size         gal         Building size required         sq.ft.         11           Costs         \$/ft         20         9           Land acquisition size required         \$/ft         20         9           Land acquisition size required size required size required         \$/ft         12           RO System size required required required required size requir	Piping per well	ft	1320	2
Trench width         ft         3         2           Excavation volume         c.y.         10           Land required         acres         10           Tank storage capacity         hrs         1           Max Influent tank size         gal           Building size required         sq.ft.         11           Costs           Building size required         sq.ft.         11           Costs           Piping cost         \$/ft         20         9           Land acquisition         \$/acre         400         1           Influent tank         \$         12           Effluent tank         \$         12           Effluent tank         \$         12           Effluent tank         \$         12           RO System         \$         13           Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs         Equipment cost markup         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Startup and test	Piping required	ft		
Excavation volume	Trench depth	ft	6	3
Land required   acres   10	Trench width	ft	3	2
Tank storage capacity hrs 1  Max Influent tank size gal  Max Effluent tank size gal  Building size required sq.ft. 11  Costs  Piping cost \$/ft 20 9  Land acquisition \$/acre 400 1  Influent tank \$ 12  Effluent tank \$ 13  Equipment building \$/sq.ft. 32.64 66  Land acquisition \$/acre 400 1  Subtotal Direct Costs  Equipment cost markup \$ 5 % of subtotal direct cost 7  Site preparation \$ 5 % of subtotal direct cost 7  Site preparation \$ 5 % of subtotal direct cost 7  Startup and testing 2 % of subtotal direct cost 7  Total Direct Cost  Insurance 1.5 % of total direct cost 7  Total Direct Cost  Total Indirect Cost  Total Indirect Cost  Total Indirect Cost  Syyr 40,000 9  Horsepower required for RO hp 75  Electrical costs \$/kwh 0.044 14  Membrane cleaning \$/1000 gal 0.011 15  Membrane replacement \$/1000 gal 0.05275 15	Excavation volume	c.y.		
Max Influent tank size         gal           Max Effluent tank size         gal           Building size required         sq.ft.         11           Costs           Piping cost         \$/ft         20         9           Land acquisition         \$/acre         400         1           Influent tank         \$         12           Effluent tank         \$         12           RO System         \$         13           Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs           Equipment cost markup         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Electrical systems         15         % of subtotal direct cost         7           Startup and testing         2         % of subtotal direct cost         7           Total Direct Cost           Insurance         1.5         % of total direct cost         8           Contingency         5         % of total direct cost         8           Total Indirect Cost <tr< td=""><td>Land required</td><td>acres</td><td></td><td>10</td></tr<>	Land required	acres		10
Max Influent tank size         gal Max Effluent tank size         gal Building size required         sq.ft.         11           Costs           Piping cost         \$/ft         20         9           Land acquisition         \$/acre         400         1           Influent tank         \$         12           Effluent tank         \$         12           RO System         \$         13           Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs           Equipment cost markup         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Startup and testing         2         % of subtotal direct cost         7           Total Direct Cost           Insurance         1.5         % of total direct cost         8           Contingency         5         % of total direct cost         8           Total Indirect Cost           Annual Operat	Tank storage capacity	hrs	1	
Max Effluent tank size Building size required         gal sq.ft.         11           Costs         Piping cost         \$/ft         20         9           Land acquisition         \$/acre         400         1           Influent tank         \$         12           Effluent tank         \$         12           RO System         \$         13           Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs         Equipment cost markup         5         % of subtotal direct cost         7           Subtotal Direct Costs         Equipment cost markup         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Electrical systems         15         % of subtotal direct cost         7           Startup and testing         2         % of subtotal direct cost         7           Total Direct Cost         8           Contingency         5         % of total direct cost         8           Contingency         5         % of total direct cost         8           Total Indirect Cost         1		gal		
Building size required   sq.ft.   11	Max Effluent tank size	•		
Piping cost	Building size required			11
Land acquisition         \$/acre         400         1           Influent tank         \$         12           Effluent tank         \$         12           RO System         \$         13           Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs           Equipment cost markup         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Electrical systems         15         % of subtotal direct cost         7           Startup and testing         2         % of subtotal direct cost         7           Total Direct Cost         Insurance         1.5         % of total direct cost         8           Contingency         5         % of total direct cost         8           Total Indirect Cost           Annual Operating and Maintenance Costs           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75           Electrical costs		•		
Land acquisition         \$/acre         400         1           Influent tank         \$         12           Effluent tank         \$         12           RO System         \$         13           Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs           Equipment cost markup         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Electrical systems         15         % of subtotal direct cost         7           Startup and testing         2         % of subtotal direct cost         7           Total Direct Cost         Insurance         1.5         % of total direct cost         8           Contingency         5         % of total direct cost         8           Total Indirect Cost           Annual Operating and Maintenance Costs           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75           Electrical costs		\$/ft	20	9
Influent tank		\$/acre	400	1
Effluent tank         \$         12           RO System         \$         13           Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs           Equipment cost markup         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Electrical systems         15         % of subtotal direct cost         7           Startup and testing         2         % of subtotal direct cost         7           Total Direct Cost           Insurance         1.5         % of total direct cost         8           Contingency         5         % of total direct cost         8           Total Indirect Cost           Annual Operating and Maintenance Costs           Total Indirect Cost           Annual Operating and Maintenance Costs           Labor cost           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75	•			12
RO System \$ 13 Equipment building \$/sq.ft. 32.64 6 Land acquisition \$/acre 400 1  Subtotal Direct Costs  Equipment cost markup 5 % of subtotal direct cost 7 Site preparation 5 % of subtotal direct cost 7 Electrical systems 15 % of subtotal direct cost 7 Startup and testing 2 % of subtotal direct cost 7  Total Direct Cost  Insurance 1.5 % of total direct cost 8 Contingency 5 % of total direct cost 8  Total Indirect Cost  Total Indirect Cost  Labor man yrs 0.5 2 Labor cost \$/yr 40,000 9 Horsepower required for RO hp 75 Electrical costs \$/kwh 0.044 14 Membrane cleaning \$/1000 gal 0.011 15 Membrane replacement \$/1000 gal 0.05275 15	Effluent tank			12
Equipment building         \$/sq.ft.         32.64         6           Land acquisition         \$/acre         400         1           Subtotal Direct Costs           Equipment cost markup         5         % of subtotal direct cost         7           Site preparation         5         % of subtotal direct cost         7           Electrical systems         15         % of subtotal direct cost         7           Startup and testing         2         % of subtotal direct cost         7           Total Direct Cost           Insurance         1.5         % of total direct cost         8           Contingency         5         % of total direct cost         8           Total Indirect Cost           Annual Operating and Maintenance Costs           Labor cost           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75           Electrical costs         \$/kwh         0.044         14           Membrane cleaning         \$/1000 gal         0.011         15           Membrane replacement         \$/1000 gal	RO System			13
Land acquisition \$/acre 400 1  Subtotal Direct Costs  Equipment cost markup 5 % of subtotal direct cost 7 Site preparation 5 % of subtotal direct cost 7 Electrical systems 15 % of subtotal direct cost 7 Startup and testing 2 % of subtotal direct cost 7  Total Direct Cost  Insurance 1.5 % of total direct cost 8 Contingency 5 % of total direct cost 8  Total Indirect Cost  Total Indirect Cost  Annual Operating and Maintenance Costs  Labor man yrs 0.5 2 Labor cost \$/yr 40,000 9 Horsepower required for RO hp 75 Electrical costs \$/kwh 0.044 14 Membrane cleaning \$/1000 gal 0.011 15 Membrane replacement \$/1000 gal 0.05275 15			32.64	6
Equipment cost markup 5 % of subtotal direct cost 7 Site preparation 5 % of subtotal direct cost 7 Electrical systems 15 % of subtotal direct cost 7 Startup and testing 2 % of subtotal direct cost 7 Startup and testing 2 % of subtotal direct cost 7  Total Direct Cost  Insurance 1.5 % of total direct cost 8 Contingency 5 % of total direct cost 8  Total Indirect Cost  Total Cost  Annual Operating and Maintenance Costs  Labor man yrs 0.5 2 Labor cost \$/yr 40,000 9 Horsepower required for RO hp 75 Electrical costs \$/kwh 0.044 14 Membrane cleaning \$/1000 gal 0.011 15 Membrane replacement \$/1000 gal 0.05275 15			400	1
Site preparation 5 % of subtotal direct cost 7 Electrical systems 15 % of subtotal direct cost 7 Startup and testing 2 % of subtotal direct cost 7  Total Direct Cost  Insurance 1.5 % of total direct cost 8 Contingency 5 % of total direct cost 8  Total Indirect Cost  Total Indirect Cost  Annual Operating and Maintenance Costs  Labor man yrs 0.5 2 Labor cost \$/yr 40,000 9 Horsepower required for RO hp 75 Electrical costs \$/kwh 0.044 14 Membrane cleaning \$/1000 gal 0.011 15 Membrane replacement \$/1000 gal 0.05275 15		·		
Site preparation 5 % of subtotal direct cost 7 Electrical systems 15 % of subtotal direct cost 7 Startup and testing 2 % of subtotal direct cost 7  Total Direct Cost  Insurance 1.5 % of total direct cost 8 Contingency 5 % of total direct cost 8  Total Indirect Cost  Total Indirect Cost  Annual Operating and Maintenance Costs  Labor man yrs 0.5 2 Labor cost \$/yr 40,000 9 Horsepower required for RO hp 75 Electrical costs \$/kwh 0.044 14 Membrane cleaning \$/1000 gal 0.011 15 Membrane replacement \$/1000 gal 0.05275 15	Equipment cost markup	5	% of subtotal direct cost	7
Total Indirect Cost		5	% of subtotal direct cost	7
Total Direct Cost		15	% of subtotal direct cost	7
Total Indirect Cost	Startup and testing	2	% of subtotal direct cost	7
Contingency         5         % of total direct cost         8           Total Indirect Cost           Total Cost           Annual Operating and Maintenance Costs           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75           Electrical costs         \$/kwh         0.044         14           Membrane cleaning         \$/1000 gal         0.011         15           Membrane replacement         \$/1000 gal         0.05275         15	Total Direct Cost			
Total Indirect Cost  Total Cost  Annual Operating and Maintenance Costs  Labor man yrs 0.5 2 Labor cost \$/yr 40,000 9 Horsepower required for RO hp 75 Electrical costs \$/kwh 0.044 14 Membrane cleaning \$/1000 gal 0.011 15 Membrane replacement \$/1000 gal 0.05275 15	Insurance	1.5	% of total direct cost	8
Total Cost           Annual Operating and Maintenance Costs           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75           Electrical costs         \$/kwh         0.044         14           Membrane cleaning         \$/1000 gal         0.011         15           Membrane replacement         \$/1000 gal         0.05275         15	Contingency	5	% of total direct cost	8
Total Cost           Annual Operating and Maintenance Costs           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75           Electrical costs         \$/kwh         0.044         14           Membrane cleaning         \$/1000 gal         0.011         15           Membrane replacement         \$/1000 gal         0.05275         15				
Annual Operating and Maintenance Costs           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75           Electrical costs         \$/kwh         0.044         14           Membrane cleaning         \$/1000 gal         0.011         15           Membrane replacement         \$/1000 gal         0.05275         15	Total Indirect Cost			
Annual Operating and Maintenance Costs           Labor         man yrs         0.5         2           Labor cost         \$/yr         40,000         9           Horsepower required for RO         hp         75           Electrical costs         \$/kwh         0.044         14           Membrane cleaning         \$/1000 gal         0.011         15           Membrane replacement         \$/1000 gal         0.05275         15				
Labor       man yrs       0.5       2         Labor cost       \$/yr       40,000       9         Horsepower required for RO       hp       75         Electrical costs       \$/kwh       0.044       14         Membrane cleaning       \$/1000 gal       0.011       15         Membrane replacement       \$/1000 gal       0.05275       15	Total Cost			
Labor       man yrs       0.5       2         Labor cost       \$/yr       40,000       9         Horsepower required for RO       hp       75         Electrical costs       \$/kwh       0.044       14         Membrane cleaning       \$/1000 gal       0.011       15         Membrane replacement       \$/1000 gal       0.05275       15				
Labor cost       \$/yr       40,000       9         Horsepower required for RO       hp       75         Electrical costs       \$/kwh       0.044       14         Membrane cleaning       \$/1000 gal       0.011       15         Membrane replacement       \$/1000 gal       0.05275       15	Annual Operating and Maintena	ance Costs		
Labor cost       \$/yr       40,000       9         Horsepower required for RO       hp       75         Electrical costs       \$/kwh       0.044       14         Membrane cleaning       \$/1000 gal       0.011       15         Membrane replacement       \$/1000 gal       0.05275       15	Lohor	mar :	0.5	_
Horsepower required for RO hp 75 Electrical costs \$/kwh 0.044 14 Membrane cleaning \$/1000 gal 0.011 15 Membrane replacement \$/1000 gal 0.05275 15		•		
Electrical costs         \$/kwh         0.044         14           Membrane cleaning         \$/1000 gal         0.011         15           Membrane replacement         \$/1000 gal         0.05275         15		-	7	9
Membrane cleaning         \$/1000 gal         0.011         15           Membrane replacement         \$/1000 gal         0.05275         15				4.4
Membrane replacement \$/1000 gal 0.05275 15				
Total Annual Costs	iviembrane replacement	\$/1000 gal	0.05275	15
	Total Annual Costs			

**DRAFT Option 4: Storage Ponds** 

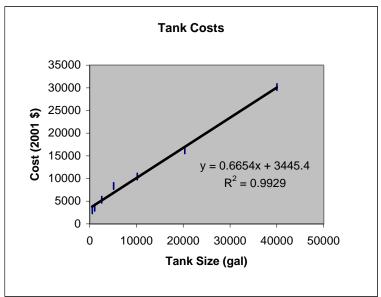
			Notes
Option Specifications			. 10100
Maximum Estimated Flow	gpm	60	1
Estimated flow	gpm		
Estimated flow	gpd		
Estimated flow	bpd		
Piping per well	ft	1320	2
Piping required	ft		_
Trench depth	ft	6	3
Trench width	ft	3	2
Trench excavation volume	c.y.	-	_
Required storage period	days	180	2
Estimated pond volume	ft <sup>3</sup>		16
Evaporation	ft/yr	4	1
Infiltration	ft/yr	4	1
Actual depth of pond	feet	16	2
Design depth (includes infiltration/evap)		24.00	
Slope of pond sides (horizontal: 1ft verti		3	
Guess width/length	feet	-	16
Calculated volume	ft <sup>3</sup>		16
Depth added for 25-yr, 24-hr storm	in	3	
Adjusted volume	ft <sup>3</sup>		16
Pond size	acre-ft		16
Pond size	c.y.		16
Land required (pond surface area + tren	•		16
Rip-rap	c.y.	10	2
Costs			
Piping	\$/s.f.	20	9
Excavation cost, pond	\$/c.y.	0.99	5
Mobilization cost	\$	194	5
Rip rap	\$/c.y.	32.4	5
Land acquisition	\$/acre	400	1
Subtotal Direct Costs	******		
Site preparation	5	% of subtotal direct cost	7
Total Direct Cost			
Insurance	1.5	% of total direct cost	8
Contingency	5	% of total direct cost	8
Total Indirect Cost		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Total Cost			
Annual Operating and Maintenance C	osts		
Labor hours	man yrs	0.1	2
Labor cost	\$/yr	\$40,000	9
Total Annual Costs			

## **DRAFT Option 5: Reinjection**

			Notes
Option Specifications			140100
Estimated flow per well	gpm	12	1
Estimated flow	gpm		
Estimated flow	gpd		
Estimated flow	bpd		
Piping per well	ft	2640	2
Piping required	ft		
Trench depth	ft	6	3
Trench width	ft	3	2
Excavation volume	c.y.		
Land required	acres		10
Well depth	2500		
Reinjection well capacity	gpm/well	0-250	
Wells required	91		
Storage time for tank	hrs	1	
Feed tank	gal		
Building size required	sq.ft.		11
Costs			
Piping cost	\$/ft	20	9
Land acquisition	\$/acre	400	1
Reinjection well costs	\$	188000	19
Tank costs	\$		12
Pump costs	\$		18
Equipment building	\$/sq.ft.	32.64	6
Land acquisition	\$/acre	400	1
Subtotal Direct Costs			
Equipment cost markup	5	% of subtotal direct cost	7
Site preparation	5	% of subtotal direct cost	7
Electrical systems	15	% of subtotal direct cost	7
Startup and testing	2	% of subtotal direct cos	7
Total Direct Cost			
Insurance	1.5	% of total direct cost	8
Contingency	5	% of total direct cost	8
Total Indirect Cost			
T			
Total Cost			
Annual Operation and Maint	nanaa Casta		
Annual Operating and Mainte	enance Costs		
Labor	man yrs	0.5	2
Labor cost	\$/yr	40,000	9
Electricity required	ΚWh	480	
Electrical costs	\$/kwh	0.044	20
	•		
Total Annual Costs			

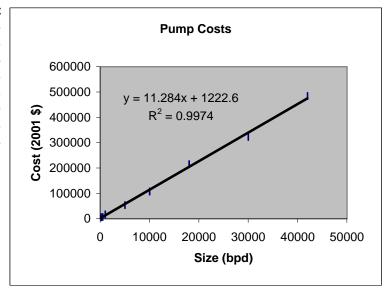
## **Tank costs from Plas-Tanks**

Size	1997 Cost	2001 Cost
529	2793	3015.846
1028	3285	3547.101
2540	4920	5312.553
5074	7743	8360.793
10147	9664	10435.06
20293	15041	16241.08
40000	27949	30178.97



## **Pumps**

Size (bpd)	1995 Cost	<b>2001 Cost</b>
200	5158	5838.703
500	5912	6692.208
1000	15259	17272.73
5000	47543	53817.26
10000	95086	107634.5
18000	190172	215269
30000	285258	322903.6
42000	427887	484355 4



- 1 Information obtained from operators (Coalbed Methane Operators Information Survey Results, September 2001) and phone calls.
- 2 Best professional judgement (BPJ) assumption.
- 3 A 6 foot depth was assumed based on the maximum depth of frost penetration.
- 4 The amount of land required was computed as the area disturbed during trenching.
- 5 Costs obtained from RSMeans Site Work and Landscape Cost Data, 20th Edition 2001.
- 6 Costs obtained from Bni Building News Mechanical/Electrical Costbook, 2001. Costs adjusted to Sheridan, Wyoming.
- 7 Percentage obtained from General Electric Corporation, DCN 15900 in EPA docket W-99-23.

  Percentage is based on Brown and Caldwell estimate and is based on historical data, MEANS, and other cost references.
- 8 Cost factors obtained from RSMeans Building Construction Cost Data, 59th Edition, 2001.
- 9 Costs obtained from CDM Camp Dresser & McKee Petroleum Association of Wyoming Coal Bed Methane Producers, Technical Support for Antidegradation Review for
- 10 The amount of land required was computed as the area disturbed during trenching plus one additional acre for the an equipment building.
- 11 From requirement list from US Filter price quote.
- 12 Costs obtained from Plas-Tanks Industries, Inc for fiberglass-reinforced plastic tanks. Updated to 2001 costs.
- 13 Costs obtained from US Filter.
- 14 Costs obtained from the Department of Energy Energy Information Administration.
- 15 Costs obtained from a US Filter proposal for a RO/Continuous Deionization system.
- 16 See pond calculation sheets. Ponds are assumed to be square with sloped sides.
- 17 E-mail correspondence with Duane Zavadil 10/04/01.
- 18 Costs taken from Development Document for the Coastal Subcategory of the Oil and Gas Extraction Point Source Category.
- 19 Costs obtained from Caribou Land & Livestock Montana, LLC.
- 20 Based on information from Wiemers Engineering LLC.